WARRANTY

KONEL warrants its products to be free from defects in material and workmanship under normal use and service. Under this warranty, we will repair or replace (at our option) free of charge any component found to be defective and returned prepaid within one year after installation, but not exceeding 15 months after shipment from the factory. This factory warranty is limited to components and does not include service technician time normally covered under the customer's purchase agreement. Complete equipment may also be returned to the factory for service when accompanied by a "Return Authorization" (See below).

On such items as tubes, lamps, fuses and accessories (not manufactured by Konel) which have a limited service life, we will extend the same guarantee as received from the manufacturer; generally 90 days. The warranty will be voided if it is found that the defects have been caused by alteration, misuse, lack of preventive maintenance, faulty installation or abnormal operating conditions.

This warranty may be held invalid unless the warranty card packed with the equipment is returned to the factory within 15 days of installation of the equipment.

Warranty service on Konel equipment is normally provided by the selling dealer. If, for any reason, this is not possible you may obtain a "Return Authorization" number or list of Service Dealers by contacting:

Service Manager
Konel Corporation
P. O. Box 2343
So. San Francisco, Ca. 94080
or
Phone (415) 588-3011
Telex 331-419 Konel SSF

The manufacturer reserves the right to make changes in specifications, designs, or prices without notice and without incurring any obligation to install changes on equipment previously sold.

NARCO konel

KR-153SB

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SCHEMATIC

Radiotelephone KR-153SB
12 Volt Power Supply K-153/12
24 Volt Power Supply K-153/24
34 Volt Power Supply K-153/34
115 Volt AC Power Supply K-153/115
Antenna Coupler KAC-150A

SECTION I

GENERAL INFORMATION

DESCRIPTION

The KONEL Model KR-153SB Single-Sideband Radiotelephone is intended to provide communications between ships and from ships to private or public shore stations. The unit provides up to 10 channels in the marine frequency bands 1.6 to 3, 4, 6, 8, 12 and 16 megacycle. Each channel may be programmed to automatically transmit and receive the desired mode; AM (amplitude modulation), SSB with pilot carrier, or SSB with suppressed carrier.

Nominal power output is 150 watts PEP when transmitting SSB. Power output when transmitting AM (carrier plus upper sideband) is 37.5 watts.

The KR-153SB meets or exceeds all applicable FCC and Canadian DOT requirements.

With the exception of four power tubes used in the transmitter section of the radiotelephone, the unit is fully solid state to reduce power drain and provide long trouble-free equipment life.

The equipment consists of the Radiotelephone, a separate Power Supply, and an optional remote Antenna Coupler. The Radiotelephone is intended for shelf or bulkhead mounting. The aluminum cabinet is easily removed for routine maintenance and service. The power supply may be mounted in any convenient location up to 8 feet from the radiotelephone.

EQUIPMENT FURNISHED

a. KR-153SB Radiotelephone

b. Power supply of specified input voltage

c. Power supply interconnecting cable (9 feet long)

d. Microphone

e. Instruction manual with circuit diagrams

ACCESSORIES AVAILABLE

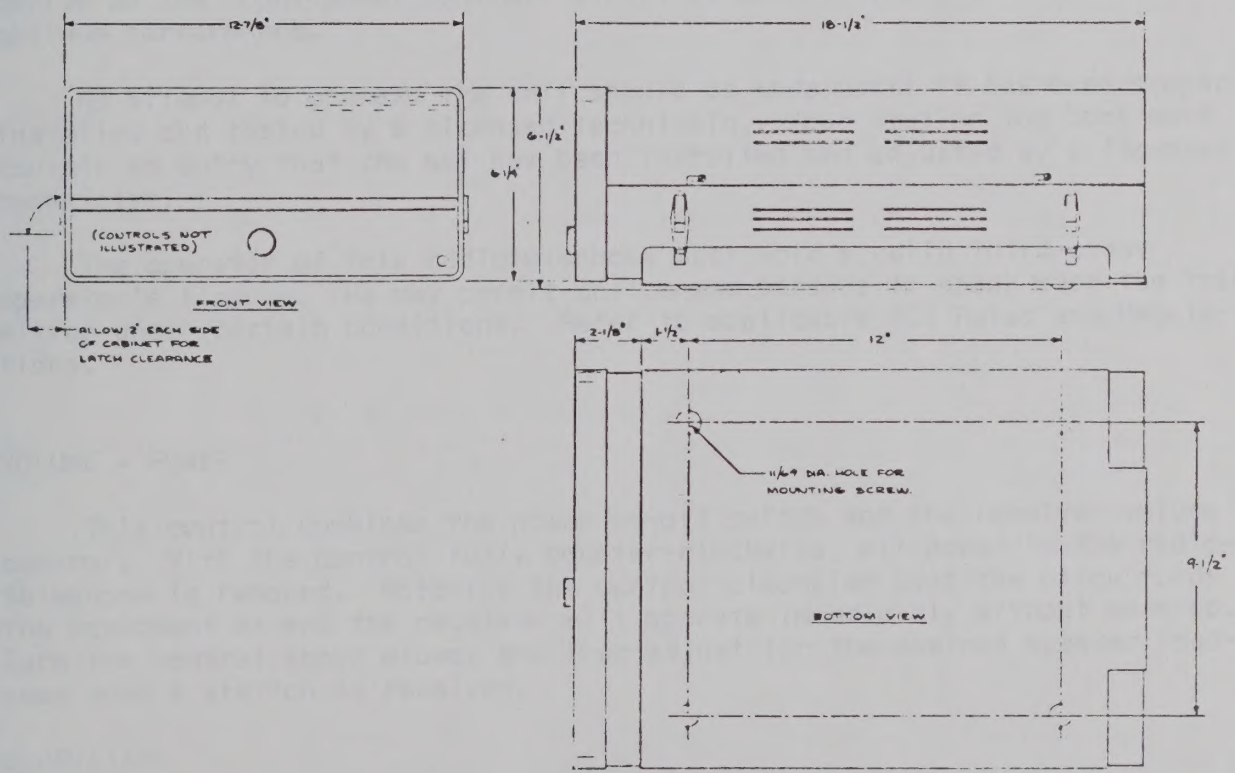
a. Quartz crystals for each operating channel

Spurious rejection: Better than 60 db down

Power requirements -

Receive only	30 watts
Transmit standby	75 watts
Transmit speech	225 to 350 watts

Mechanical - Radiotelephone dimensions: $6\frac{1}{4}$"H x 12 3/4"W x $17\frac{1}{4}$"L
Radiotelephone weight: 25 lbs.
Power Supply dimensions: $6\frac{1}{2}$"H x 7 3/4"W x $12\frac{1}{2}$"L
Power Supply weight: 12V & 34V - 11 lbs.
115V AC - 38 lbs.



SECTION II

OPERATION

CAUTION

DO NOT ATTEMPT TO TRANSMIT UNTIL THE RADIOTELEPHONE IS WARMED UP FOR AT LEAST 10 MINUTES. The crystals that control the transmitting frequency are contained in precision ovens that require at least 10 minutes to rise to correct temperature. Transmitting before the 10 minutes warm-up period has elapsed, can cause a violation of FCC regulations.

GENERAL

The KR-153SB Single-Sideband Radiotelephone will provide communications between ships and from ships to private or public shore stations. The method of operating the unit is simple and straightforward but the following information on the front-panel controls should be carefully studied to insure optimum performance.

No attempt to operate the unit should be made until it has been properly installed and tested by a licensed technicain. Your station log book must contain an entry that the set has been installed and adjusted by a licensed technician.

The operator of this radiotelephone must hold a valid third-class operator's license. He may permit unlicensed persons to speak over the transmitter under certain conditions. Refer to applicable FCC Rules and Regulations.

VOLUME - POWER

This control combines the power on-off switch and the receiver volume control. With the control fully counter-clockwise, all power to the radiotelephone is removed. Rotating the control clockwise past the click turns the equipment on and the receiver will operate immediately without warm-up. Turn the control about midway and then adjust for the desired speaker loudness when a station is received.

CLARIFIER

This control is used when receiving single-sideband stations to "fine-tune" the receiver for best clarity. Adjust until the voice being received sounds natural and clear. The Clarifier control is not used when receiving AM stations and will not affect the quality of reception from this type of signal.

SQUELCH

The squelch control is provided to eliminate bothersome noise and static when no station is being received. To operate, wait until no signal is being heard and then slowly turn the squelch control counter-clockwise until speaker noise just disappears. The control should not be reduced below this point since the ability of the set to receive weak stations would be impaired.

LOCAL/DISTANCE SWITCH

This switch is part of the squelch control. When the squelch control knob is pulled outward the receiver sensitivity is reduced to provide greater clarity on strong local signals.

METER

A meter and meter switch are provided to give indications of correct transmitter operation. The meter switch should be left normally in RF position. In RF position, the meter needle will swing up whenever the microphone is spoken into and gives a direct indication of transmitter power being delivered to the antenna. The amount of the meter indications will vary somewhat for each channel and this does not necessarily mean that the transmitter is radiating more power on one channel or another. The reading only indicates that the transmitter is on the air and the operators voice is being radiated.

With the meter switch in HV position, a reading of approximately .8 should be given when the microphone button is pressed. This indicates that the correct high voltage is being applied to the transmitter tubes.

In PA position, a reading between .1 and .2 will be given when the microphone button is pressed. The reading varies from one channel to another with the .1 reading typical for a SSB channel and the .2 reading correct on a AM channel. When the microphone is spoken into, the meter reading will increase somewhat in either case. In PA position, the meter indicates the amount of current being consumed by the transmitter tubes.

RECEIVE -STANDBY SWITCH

The Receive-standby switch is provided to enable the radiotelephone to function as a receiver only at greatly decreased power drain. With the switch in RECEIVE position, heater power is removed from the transmitter tubes and power drain from the ship's battery is lowered. The receiver portion of the set continues to function normally. When it is desired to transmit, the switch should be operated to STANDBY position. Allow 30 seconds for the transmitter tubes to warm up before pressing the microphone button. Note that the transmitter crystal ovens are kept on even with the switch in RECEIVE position so that it is not necessary to wait 10 minutes after switching to STANDBY

before transmitting.

The switch should be left in RECEIVE position when it is not expected that the transmitter will be used within the next half hour. This will increase the life of the transmitter tubes considerably.

CHANNEL SELECTOR

The channel to be used is selected by the Channel selector. The actual channel frequencies will be labelled on the front panel at the time of installation. It will not be possible to operate the transmitter on a channel without proper crystals installed. The Channel selector should never be switched when the microphone button is pressed since this can damage the switch mechanism.

OPERATING THE SINGLE-SIDEBAND TRANSMITTER

Operating the single-sideband (SSB) radiotelephone is quite similar to conventional AM equipments. After the desired channel is selected, press the microphone button and begin speaking. Speak in a normal tone of voice with the microphone held close to the mouth. DO NOT SHOUT. The transmitter incorporates an Automatic Level Control that adjusts the unit for variations in voice level. Shouting is not only unnecessary; it does not increase transmitter output and only garbles the signal so that intelligibility is reduced. An indication of garbling is given by the panel meter in RF position. If the meter stays nearly steady when the microphone is spoken into, you are speaking too loud. When operated correctly, the meter swings between .1 and a midscale reading as each syllable is pronounced.

Remember that no carrier is being transmitted. Even though the microphone button is pressed, no signal appears on the air until you begin speaking. You cannot acknowledge a transmission from the other station by merely "blipping" the button; the receiving station will hear nothing until you actually speak.

SSB-AM SWITCH

The SSB-AM Switch is used to give the operator the option to transmit and receive either SSB or compatible AM (A3H). On channels where AM only is mandatory (2182 KHz) AM is automatically selected by the radio internal programming.

All remaining channels are programmed for SSB (simplex or telephone duplex, as required). In the event it is necessary to communicate with a vessel or shore station not yet converted to SSB, the front panel MODE switch AM position is selected.

Caution: Use of AM above 4 MHz is prohibited. The aforementioned instructions apply only to 2-3 MHz frequencies.

SECTION III

INSTALLATION

GENERAL

Installation of the KONEL KR-153SB consists of locating and mounting the Radiotelephone and power supply, installing a suitable antenna and ground system, and installing any desired remote operating facilities.

RADIOTELEPHONE AND POWER SUPPLY

Select a convenient operating location for the radiotelephone. The cabinet and mounting plate are reversible. Thus, the radiotelephone may be arranged to mount on any flat surface either vertical or horizontal. The location selected should allow at least one inch of space next to the top of the cabinet for purposes of ventilation.

The power supply is intended for mounting to any flat surface and may be located up to 8 feet distant from the radiotelephone. The wires or cable connecting the power supply to the ship's power source should be short and direct and of adequate size. For a 12-volt installation use no smaller than 8 B&S gauge wire. For 32-volt dc and 115-volt ac systems #10 gauge wire is adequate if the connecting cable is not longer than 15 feet.

ANTENNAS

The radiotelephone requires an antenna load of 50 ohms with low VSWR for correct operation. For all-band operation, the KONEL Model KAC-150A, Remote Antenna Coupler is recommended. This coupler is designed to match whip antennas as short as 15 feet and as long as 35 feet or to a wire antenna up to 60' long. Instructions for installing and adjusting the Remote Coupler are given in the manual accompanying the unit.

If the Remote Coupler is not used, A multi-band or 'trap' antenna should be considered for the high-frequency bands.

GROUND SYSTEM

On wood vessels, a copper ground plate of at least 30 square feet should be attached to the outside of the hull. Studs should be brazed to each end of the plate to serve as connections to the radiotelephone. Connections should be as short as possible and should be made with flat copper strap at least .025" thick and two or more inches wide.

If a long ground is necessary, two or more separate runs of flat strap should be used to each stud. The ground system may be improved by bonding all metal objects in the vicinity of the installation to the ground strap. Bonding connections should be soldered if possible.

NOISE SUPPRESSION

The KR-153SB incorporates a highly sensitive receiver which responds to interfering electrical noise much the same as conventional AM receivers. While the use of the Squelch control will alleviate much of the annoyance of noise, optimum performance can only be obtained if the electrical system of the vessel is treated for suppression of noise. The techniques to be used are identical to those used for a conventional AM installation and include bypassing and filtering of the generators or alternators, and installing radio suppressors or shielding the ignition wiring.

SECTION IV

THEORY OF OPERATION

GENERAL

This section assumes that the reader is familar with the operation of conventional AM transmitters and receivers. Special emphasis is given to those parts of the radiotelephone which differ from the circuits customarily used in AM equipment.

SINGLE-SIDEBAND TRANSMISSION AND RECEPTION

The Single-sideband (SSB) transmitter differs from its AM counterpart in two important respects. Modulation is applied to the outgoing signal in a low-level stage and then amplified by a series of stages to the final output level. The low-level modulated signal cannot be multiplied to the final output frequency; it must be converted to the desired frequency by mixers.

The SSB receiver differs from an AM receiver only in the type of detector circuit used and special treatment which must be applied to the AGC system.

BLOCK DIAGRAM

Referring to figure 4-1, a signal arriving at the antenna is passed through a plug-in coil resonant at the signal frequency and applied to an r-f amplifier. The amplified signal is then fed through another resonant plug-in coil and converted to an intermediate frequency of 5.1 Mhz. A sharply-tuned 5.1 Mhz L-C filter removes the undesired mixing components. The filtered 5.1 Mhz signal is then converted by a second mixer to 455 Khz. At this point the signal takes one of two paths depending upon the type of reception programmed for the channel in use. If AM reception is programmed, the signal is passed through a 455-Khz mechanical filter having a 6-Khz passband. The signal is then amplified and detected by a conventional diode detector. A series-gate diode limiter (ANL) removes interference noise and the audio signal is then amplified and passed to the speaker. R-F energy is taken from the 455-Khz amplifier to operate the AGC system of the receiver and the AGC voltage also actuates a squelch circuit which switches one of the audio amplifier stages on and off as required.

When the receiver is programmed to receive SSB, output from the second mixer is amplified at 455 Khz and passed through a 455-Khz mechanical filter with a 2.1 Khz passband. The filtered signal is then combined with a 456.5 Khz carrier oscillator in a diode-quad demodulator to produce an audio signal. This audio signal is then amplified and passed to the speaker. In the SSB mode, the AGC amplifier is actuated by the amplified signal from the diode quad since there is no received carrier to act as a reference level.

Several of the circuits used in reception are also used in the transmit function. Speech from the microphone is passed through an automatic level control (ALC) gate and applied to the diode quad. Here the audio signal is combined with the 456.5 Khz reference oscillator to produce an upper and lower sideband r-f output. The reference oscillator signal is greatly attenuated in the output of the diode quad. Output from the quad is passed through the 2.1 Khz passband filter which removes the upper sideband leaving only the lower sideband signal. A carrier insert circuit adds a desired amount of the 456.5 Khz reference oscillator output to the signal passed by the filter. The amount of carrier inserted may range from zero to a high level as required for the type of transmission programmed for each channel.

Output from the 2.1 Khz passband filter is amplified and converted to 5.1 Mhz and then passed through the 5.1 Mhz L-C filter. The signal is then converted to the desired operating frequency by a second mixer which also receives an injection higher than the desired operating frequency. Due to the "high side" injection, the signal is inverted to upper sideband. Output from the second mixer is applied to a two-stage linear amplifier which increases the power to 150 watts. Output from the amplifier is coupled through a conventional pi-net coupler to the antenna system.

A diode rectifier coupled to the grids of the last linear amplifier produces a dc output when the SSB signal reaches the level required to produce 150 watts output. This dc output is amplified and applied to the ALC gate and greatly attenuates the microphone input signal so that further output from the transmitter cannot occur. Thus, regardless of the level of speech, the transmitter is limited to the desired output.

CIRCUIT DIAGRAM

NOTE: In the following description, reference is made to +R lines and +T lines. A +R line connects to the 11-volt supply when the unit is in Receive and to ground when the unit is in Transmit. Conversely, the +T line connects to the 11-volt supply when the unit is in transmit and to ground when the unit is in Receive.

CIRCUIT DIAGRAM

RECEIVE FUNCTION

An incoming signal at the antenna is applied through the input plug-in coil to Q101 and Q102 which are arranged in a cascade configuration. Gain of this stage is automatically controlled by a positive-going voltage applied through R107 which reduces current flow through both transistors thus reducing amplification.

The amplified signal is applied through a second plug-in coil to mixer Q103 which also receives an injection through C105 from the Receive Oscillator

Q201 and Q202. The output circuit of this mixer is tuned to 5.1 MHz by L102 and C106. Source follower Q104 is provided to impedance match the mixer output to the low-impedance input of the 5.1 MHz L-C filter T301 and T302.

Output from T302 is applied to second mixer Q301 which received a 4643.5 KHz injection from oscillator Q313. The 455 KHz output from this mixer is fed to the input of 6 KHz passband filter FL301. The signal at this point is also applied through C307 to the input of SSB amplifier Q302 which will be discussed later in this section.

Output from FL301 is amplified by Q303 and Q304 and applied to a 455 KHz resonant load L301 and C317. The AM signal IF is then detected by CR301. The audio signal is then passed through the volume control R431 and amplified by Q309, Q310 and Q402. Power from Q402 is transformed to speaker impedance by T425.

A portion of the r-f signal developed in the output of Q304 is applied through C315 to AGC amplifier Q305. This stage is arranged to be cutoff in the absence of an incoming signal. Thus, the voltage at the collector of Q305 is quite low. When a signal appears, Q305 conducts and the potential on its collector rises toward the +11 volt supply voltage. This potential is applied through R107 and R108 to the r-f amplifier and first mixer to provide AGC action. The voltage also charges C330 to provide an adequate time constant for the AGC action. Finally, the AGC voltage is applied through Squelch control R435 to the squelch gate Q311. This stage is connected in series with audio amplifier Q309. If Q311 is not in conduction, no audio passes through Q309. With the Squelch control properly set, Q311 does not conduct unless an incoming signal is present and AGC voltage is generated. Thus, audio to the speaker is squelched off in the absence of a signal.

When the unit is programmed to receive AM signals, a control line is connected through a bandswitch section to the +R line. This control line performs three functions; Carrier oscillator Q316 is turned off by the high positive bias applied to its source through R363, AM amplifier Q303 is turned on by the positive bias applied to its base through R314, and SSB audio amplifier Q307 is turned off by the high positive potential applied to its emitter through R329. When the unit is programmed to receive SSB, this control line is grounded causing the AM i-f amplifier (Q303) to be turned off and the carrier oscillator Q316 and the SSB audio amplifier Q307 to operate.

With the unit set to receive SSB signal, the signal appearing at the input of FL301 is amplified by Q302 and applied to the input of 2.1 KHz passband filter FL302. Output from this filter is combined with a 456.5 KHz reference in diode-quad demodulator CR306-CR309. The resultant audio output is amplified by Q308 and Q307 and passed through R325 and C316 to the AGC amplifier. This audio signal actuates the AGC system in the same manner as described for AM reception.

TRANSMIT FUNCTION

When the microphone button is pressed, relays K401 and K402 are energized

connecting the +R line to ground and the +T line to the 11 volt supply bus. The antenna is also disconnected from the receiver input and connected to the transmitter output.

With the button pressed an audio signal from the microphone is passed through R388 to the source of ALC gate Q320. The signal is also coupled through C374 to the gate of this stage. With zero bias applied to the gate through CR317, the resistance between source and drain is quite low and the audio signal readily passes through. When a negative dc bias is applied to the gate the resistance between source and drain rises rapidly and the audio signal is greatly attenuated. Thus Q320 acts as a voltage-variable level control.

Output from Q320 is amplified by Q319 and fed through L302 to the input of diode-quad modulator CR306-CR309 where it is combined with the 456.5 KHz reference from Q316 to produce upper and lower sidebands centered around the reference. These sidebands are then applied to FL302 which greatly attenuates the upper sideband and the reference oscillator signal. When SSB transmission is desired this attenuation is necessary. However, when other types of transmission are needed, some reference (sometimes called carrier) output is required. Diode CR305 provides a means of reinserting a controlled amount of reference signal in the output of FL302. A small amount of the reference signal is coupled through C348 to the anode of CR305. The cathode of this diode is connected through R354 to the filter output. R354 also places a small reverse bias on the cathode of CR305. A dc control voltage is applied through R356 to the diode anode. With no control voltage applied, the diode is reverse biased and no reference signal passes through. Two potentiometers R429 and R430, can be adjusted to provide values of dc control voltage through R357 such that CR305 passes an amount of reference signal equal to either -16db or -6db from full output as desired. In addition, when TUNE-OPERATE switch S405 is in TUNE position, a high level of dc control voltage is applied to CR305 and full reference (or carrier) appears in the transmitter output for tune-up purposes.

Output from FL302 is amplified by Q315 and applied to mixer Q314 which also receives a 4643.5 KHz injection from Q313. The 5.1 MHz output from Q314 is passed through the 5.1 MHz filter T301 and T302 and applied to second mixer Q312. This mixer also receives an injection from High-frequency oscillator Q203 and Q204 to convert the 5.1 MHz signal to the desired operating frequency.

The signal from Q312 is passed through a plug-in coil and amplified by V403. The gain of this stage can be adjusted for each channel by variable resistors switched for each channel. Thus, the overall gain of the transmitter section of the unit is set to be equal on each channel.

Output from V403 is fed through a plug-in coil and applied to the grids of final amplifier V404-V406 which increases the signal level to 150 watts. Final amplifier output is matched to the antenna by a pi-net coupler pretuned for each channel.

A portion of the signal applied to the final amplifier grids is coupled through C421 to ALC diode CR402. This diode is biased through R420 and R421 so that it conducts only when the positive peaks of the drive signal approach ground potential by overcoming the high negative bias on the final amplifier grids. When CR402 conducts, A positive dc output is obtained which is applied to the base of Q401. The dc output causes Q401 to conduct and its collector potential changes from ground potential to some negative value. This collector potential is then applied to ALC gate Q320 to increase the attenuation through this stage thus causing the microphone signal to be reduced to a level which will result in no more than required to produce 150 watts output.

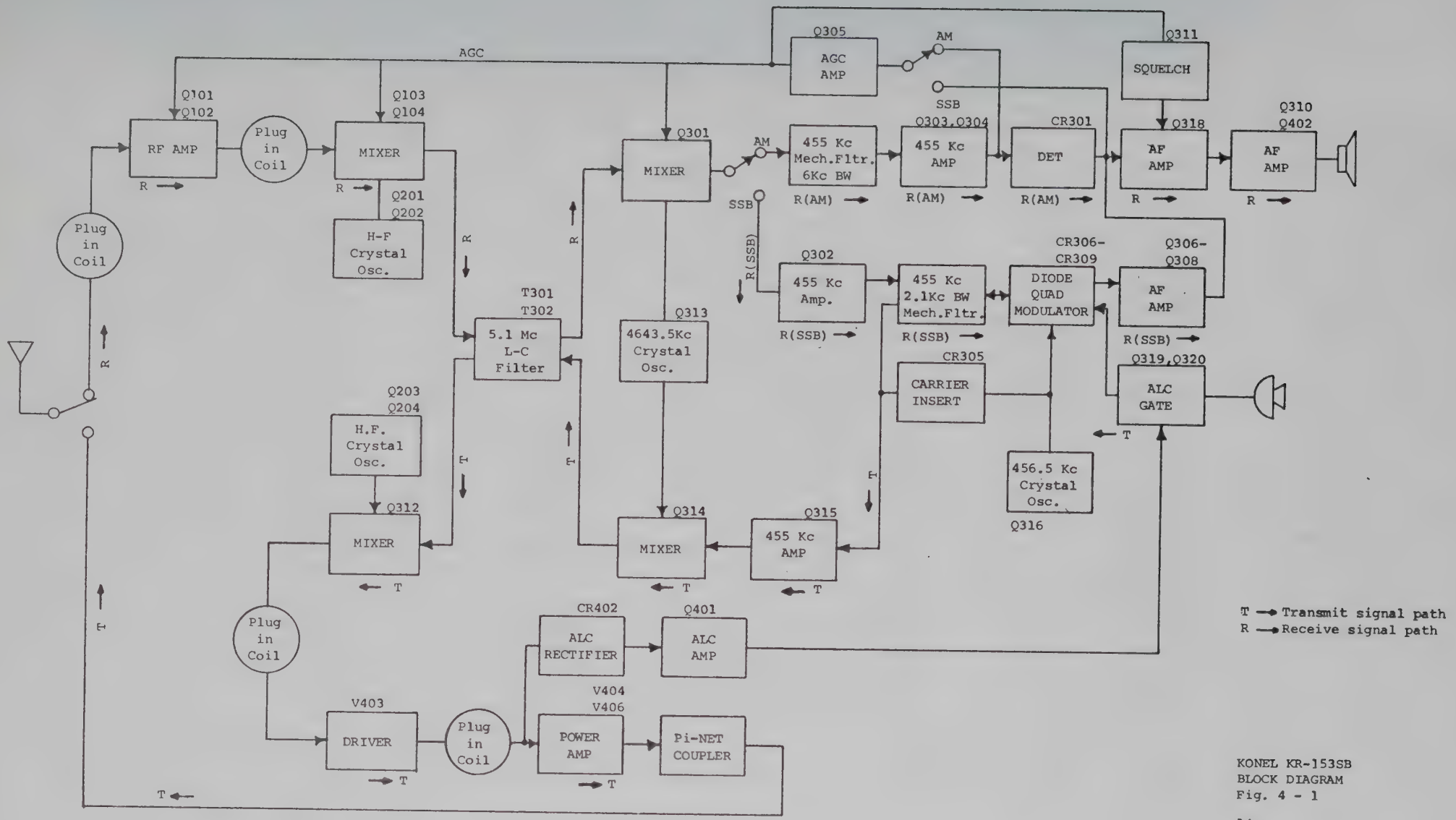
CONTROL CIRCUITS

A push-to-talk interlock circuit is provided to prevent operation on channels not properly equipped for transmitting. The push-to-talk line from the microphone is passed through a section of the bandswitch so that the circuit is completed only on the desired channels. In addition, this line is fed through the receptacle serving the remote antenna coupler site when the TUNE-OPERATE switch is in TUNE position.

A HI-LO TUNE POWER Switch on the rear panel permits adjustments to the Antenna Coupler with the transmitter delivering only moderate power output (15 to 30 watts). Final performance checks of the coupler must be done with the switch in HI power position.

A RECEIVE-STANDBY switch is provided on the front panel. This switch when in RECEIVE position removes voltage from the transmitter tube heaters and prevents application of high voltage to the transmitter tubes even when the microphone button is pressed.

A front panel meter is connected through a three-position switch to monitor three circuits of the transmitter. Final amplifier dc current is measured by connecting the meter across R424 in the final amplifier cathode circuit. The meter can also be switched to read the final amplifier plate voltage. Finally, the meter indicates r-f output from the transmitter by reading the dc output from diode CR401 which is connected through a voltage divider to the antenna terminal.



KONEL KR-153SB
BLOCK DIAGRAM
Fig. 4 - 1

SECTION V

TEST & ALIGNMENT

GENERAL

The KR-153SB is normally supplied by the factory with crystals installed and aligned to the operating frequencies specified by the customer. This section will outline necessary procedures for installing added channels or changing the operating frequency of a given chennel.

Complete alignment of the unit as a maintenance procedure is not recommended. Specific adjustments to various circuits that may require field attention is given in this section.

EQUIPMENT REQUIRED

The procedures given below require the use of all or a part of the following test devices:

Signal Generator, H-P 606A or equal
R-F VTVM, HP-410-B or equal
Oscilloscope, 20 Mhz response minimum
Frequency Counter, H-P 5245L with H-P 5261 video amplifier or equal
50-ohm dummy load, 250 watt minimum rating
Two-tone audio test generator
Audio VTVM, H-P 400AD or equal

CHANNEL ALIGNMENT

The KR-153SB may be equipped with a maximum of six sets of plug-in coils. There are two basic types of coils, one type for the receiver antenna input circuit and the other for use in the receiver mixer circuit and the two transmitter driver circuits.

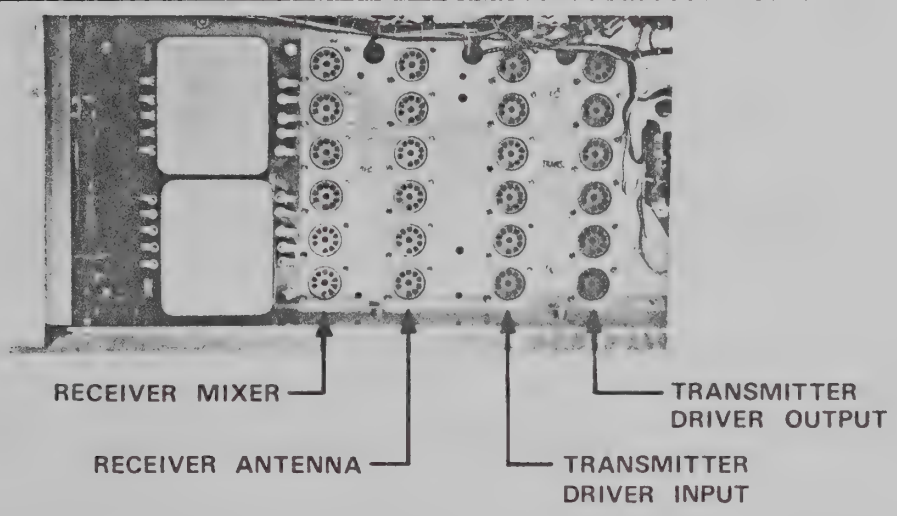
The receiver antenna input coils have a 50 ohm primary input winding and a secondary winding and are marked with a number designating the frequency band in megahertz.

The other coils are marked with a "T" proceeding the frequency band number. These coils have two windings each of which can be tuned and switched as necessary when the operating frequencies in any one band are separated by more than 2% of the lower frequency.

The following chart shows the coils available and their use in the KR-153SB.

NOTE: Pin #2 of all #1076 ("T" & "R") type coils is the hot end of the second winding.

COIL MARK	FREQ IN MHZ	WHERE USED	KONEL PART #
2	2-3	Receiver Antenna	1075-02
4	4	" "	1075-04
6	6	" "	1075-06
8	8	" "	1075-08
12	12	" "	1075-12
17	17	" "	1075-17
T2	2-3	Rec. Mixer & Trans	1076-02
T4	4	" "	1076-04
T6	6	" "	1076-06
T8	8	" "	1076-08
T12	12	" "	1076-12
T-16	16	Trans Only	1076-16
R-17	17	Rec. Mixer Only	1076-17



Two or more operating frequencies may be obtained from a single coil set provided that the difference between the two (or more) frequencies does not exceed 5% of the lowest frequency to be obtained.

To prepare the unit for operation of a new channel, perform the following:

1. Connect four bandswitch wafers to plug-in coil sockets. If a set of coils for the new frequency band are already installed, connect the wafers to the sockets for these coils. If plug-in coils for the desired band are not already installed, connect the wafers to vacant sockets and install a set of four plug-in coils for the desired band.

2. Connect the four bandswitch wafers associated with the final amplifier to the pi-net components designated for the desired band.

Make certain that the correct amount of fixed capacity is connected across the PA Tuning capacitor for the band in use.

BAND	FIXED C ACROSS PA TUNING CAP.
1.6 MHz	800 pf
2.0 - 2.5 MHz	700 pf
2.5 - 3.0 MHz	600 pf
4.0 MHz	200 pf
6.0 MHz	150 pf
8.0 MHz	100 pf
12.0 MHz	None
17.0 MHz	None

In addition, a fixed capacity of 1000-2000 pf is required in parallel with the PA Loading capacitor on all frequencies below 2.5 MHz.

3. Connect the front wafer of the bandswitch for the desired receiving mode. If AM reception is desired, connect the wafer contact to the +R line (orange lead). If SSB reception is desired, connect the contact to ground (brown lead).

4. Connect the Transmit Mode wafer of the bandswitch for the desired transmitting mode. If full SSB is desired, leave the contact unconnected. For -16db carrier, connect to the center lug of the -16db carrier control; for AM transmission, connect to the -6db carrier control.

5. Connect the Interlock wafer of the bandswitch so the circuit through this wafer is completed on the desired channel.

6. Install crystals in the appropriate receive and transmit crystal sockets. The crystal frequency for both receive and transmit is the desired operating frequency plus 5100 KHz. Transmit crystals must be type CR-27/U, Konel P/N 2176.

7. Connect unit to power source and operating in Receive mode for 30 minutes. Set Clarifier control to mid-range (mechanically 1/3 of plates are meshed) and connect low-capacity probe of counter to Rx output post on HF oscillator board. Adjust appropriate trimmer capacitor until counter reads exact operating frequency plus 5100 KHz.

8. Connect the Signal Generator to the antenna receptacle and adjust generator frequency to desired operating frequency. Adjust Receive RF and MIXER plug in coils for maximum speaker output reducing generator output as required to prevent overload.

9. Connect antenna receptacle to 50-ohm dummy load and connect oscilloscope probe to antenna post. Connect the two-tone generator to the microphone terminals and adjust for an audio output of about 0.5 volts p-p. (If channel is programmed for AM, use a single tone at 0.5 volts p-p). Press the microphone button and adjust both transmit plug-in coils for maximum final-amplifier current. Adjust PA Tune and PA Load capacitors for maximum scope indication. If necessary, increase audio tone amplitude slightly to obtain maximum output. Scope amplitude should be at least 240 volts p-p when transmitter is correctly tuned.

10. Note amplitude of scope display. Remove tone but keep microphone button pressed. If channel is programmed for AM, adjust the appropriate transmit GAIN control until remaining carrier indication is exactly half the scope amplitude obtained with tone connected. If channel is programmed for pilot carrier transmission, adjust appropriate GAIN control until remaining carrier is 16% of amplitude obtained with tone connected. If full SSB is programmed, adjust appropriate transmit GAIN control so that voice peaks reach full scope amplitude whtn the microphone is spoken into in a normal tone and level.

11. Loosely couple the counter to the antenna post so that a stable frequency count is obtained. (If full SSB is programmed, insert a tone of exactly 1000 Hz. Subtract the tone frequency from indicated transmitting frequency to obtain correct operating frequency). Adjust appropriate transmit high-frequency crystal trimmer until counter indicates the exact operating frequency desired.

FIELD ADJUSTMENTS

The adjustments described below can be made with the test equipment listed at the start of this section.

VOLTAGE REGULATOR

Connect an accurate dc voltmeter between terminal 7 and chassis of the power supply. Adjust voltage regulator control until voltmeter indicates exactly 11.0 volts.

5.1 MHZ L-C FILTER

Adjust unit to receive on a channel programmed for SSB. Connect signal generator to antenna receptacle and adjust generator to receiving frequency.

Set generator until receiver output is just audible. Align four slugs of T301 and T302 for best receiver output.

5.1 MHZ TRAP

Adjust unit to receive on a channel programmed for SSB. Connect signal generator to antenna receptacle and set for high output. Tune signal generator near 5.1 Mhz until response is heard in speaker. Tune 5.1 Mhz trap capacitor (C409) for minimum receiver output.

CARRIER BALANCE

Accurate carrier balance is important only if transmitter is to be operated in full SSB mode. Set unit to transmit on a channel programmed to transmit full SSB. Connect dummy load to antenna terminals. Press microphone button but muffle microphone so that no microphone output is obtained. Meter will indicate residual carrier. Alternately adjust Carrier balance Potentiometer (R360) and Carrier balance trimmer (C345) for minimum meter reading. Meter should indicate 0.2 volts rms or less with correct adjustment. NOTE: Allow 30 minutes warm-up before making this adjustment.

CARRIER INSERT

Set unit to transmit on the highest frequency channel programmed for pilot carrier transmission. Connect dummy load to antenna receptacle and connect R-F VTVM across antenna terminals. Connect two-tone audio generator to microphone terminals and adjust for full transmitter output. Note reading on VTVM. Remove two-tone audio input and adjust appropriate transmit GAIN control for a meter reading of 16% of that obtained with two-tone audio applied. If correct amount of meter reading cannot be obtained by adjusting GAIN control, readjust -16db carrier adjust potentiometer for a reading of 16% with transmit GAIN control fully clockwise. NOTE: If -16 db carrier adjust potentiometer is readjusted, each channel programmed for pilot carrier transmission must be readjusted as outlined in step 10 of the CHANNEL ALIGNMENT paragraph of this section.

The -6 db carrier adjust potentiometer is set similarily to the above using the highest frequency channel programmed for AM transmission. Adjust the -6 db carrier adjust potentiometer for a meter reading exactly 50% of that obtained with two-tone audio applied. Readjust the transmit GAIN controls for all channels programmed for AM transmission.

TRANSMIT GAIN CONTROLS

The transmit GAIN controls are provided to equalize the transmitter gain on all channels. This is important when transmitting AM and pilot carrier modes in order that the inserted carrier will be equal on all channels. When transmitting full SSB, the transmit GAIN controls serves as a microphone

gain control and is set for the correct amount of microphone gain. Too much microphone gain allows undesirable background noise to be transmitted; too little microphone gain reduces transmitter output. Since the overall transmitter gain becomes less as the operating frequency is raised, the carrier insert controls should be set for the correct amount of inserted carrier at the highest operating frequency. The transmit GAIN controls on the lower frequency channels are then set so the correct level of carrier is transmitted on each channel.

ALC ADJUSTMENT

Set the unit to transmit on the highest frequency in use. Connect the dummy load to the antenna receptacle and the scope to the antenna terminals. Connect the two-tone audio generator to the microphone terminals. Press the microphone button and increase the two-tone input by at least 6 db and observe the appearance of the two-tone pattern on the oscilloscope. If evidence of 'flat-topping' is noted, readjust the ALC control slightly until it just disappears. NOTE: Some instability of the two-tone pattern will be observed with the two-tone generator set at very high input levels. This is caused by audio distortion introduced by the ALC gate as its bias approaches cutoff. This distortion can be ignored since it does not affect clarity of speech.

TUBE REPLACEMENT

The driver and final-amplifier tubes may require replacement after many hours of operation. Evidence of weak tubes will be lack of microphone gain and low transmitter output. When the final amplifier tubes are replaced, the neutralization adjustment should be checked. Operate the transmitter with the TUNE-OPERATE switch in TUNE position and note that maximum transmitter output occurs at the same setting of the PA tune capacitor produces minimum final amplifier current. If the two settings do not coincide, readjust the neutralizing trimmer (C422) slightly until this condition is obtained. This adjustment is very critical and trial settings of 1/8 turn of the trimmer should be made until the correct setting is found. The adjustment should be made on the highest frequency channel in use. If a higher frequency channel is installed at some later date, the neutralization adjustment should be made with this new channel

TROUBLESHOOTING

With the exception of the four tubes in the transmitter section of the KR-153SB, all components of the unit may be expected to perform indefinitely. Relay contacts may require occasional burnishing; evidence of faulty contacts is usually erratic operation of either the receiver or transmitter.

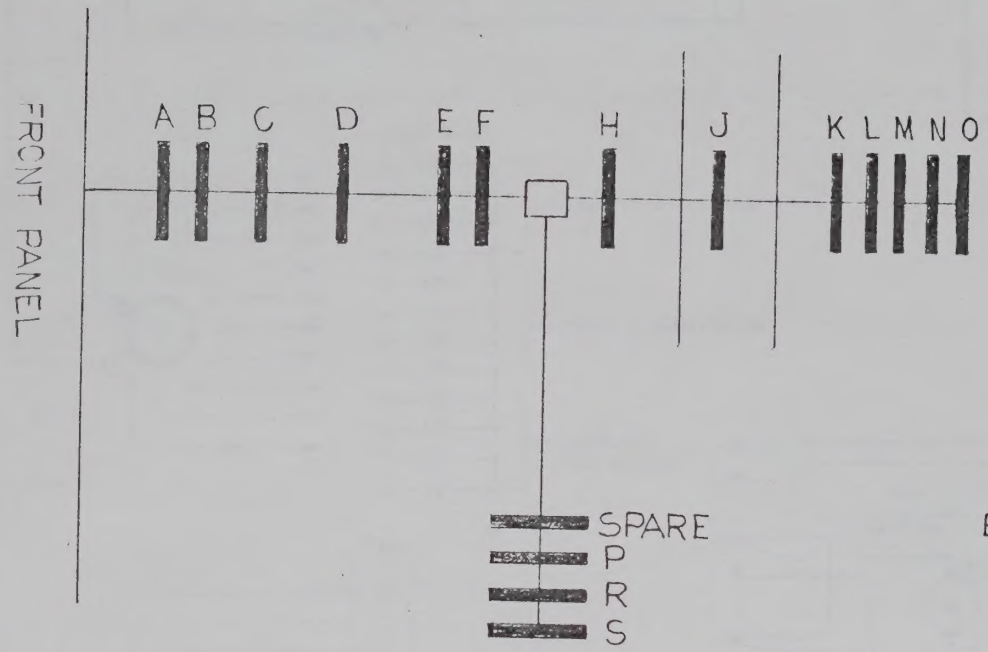
All circuits within the power supply are protected by fuses and these should be examined in the event of sudden malfunction. Never replace a fuse with one of a heavier rating since this can cause damage to other components.

Important voltages are given on the circuit diagram contained in this manual. In the event of malfunction, voltages near the section suspected of faulty operation should be checked and any severe discrepancies investigated. Resistance measurements within a circuit are often misleading since the semiconductors within that circuit can cause a false reading. Voltage measurements usually give a more accurate indication of the circuit condition.

Coil # →		RF		ANT.		Grid		Plate				
Switch Wafer		D		E	F	H		J				
Chan. Sw.	Rec. Freq. Operating	Pin No.	Coil Letter	Pin No.	Pin No.	Chan. Sw.	TX Freq. Operating	Pin No.	Coil Letter	Pin No.	Mode	Cart-wheel Caps	Wir Tap
1						1							
2						2							
3						3							
4						4							
5						5							
6						6							
7						7							
8						8							
9						9							
10						10							

Konel S.O. # _____

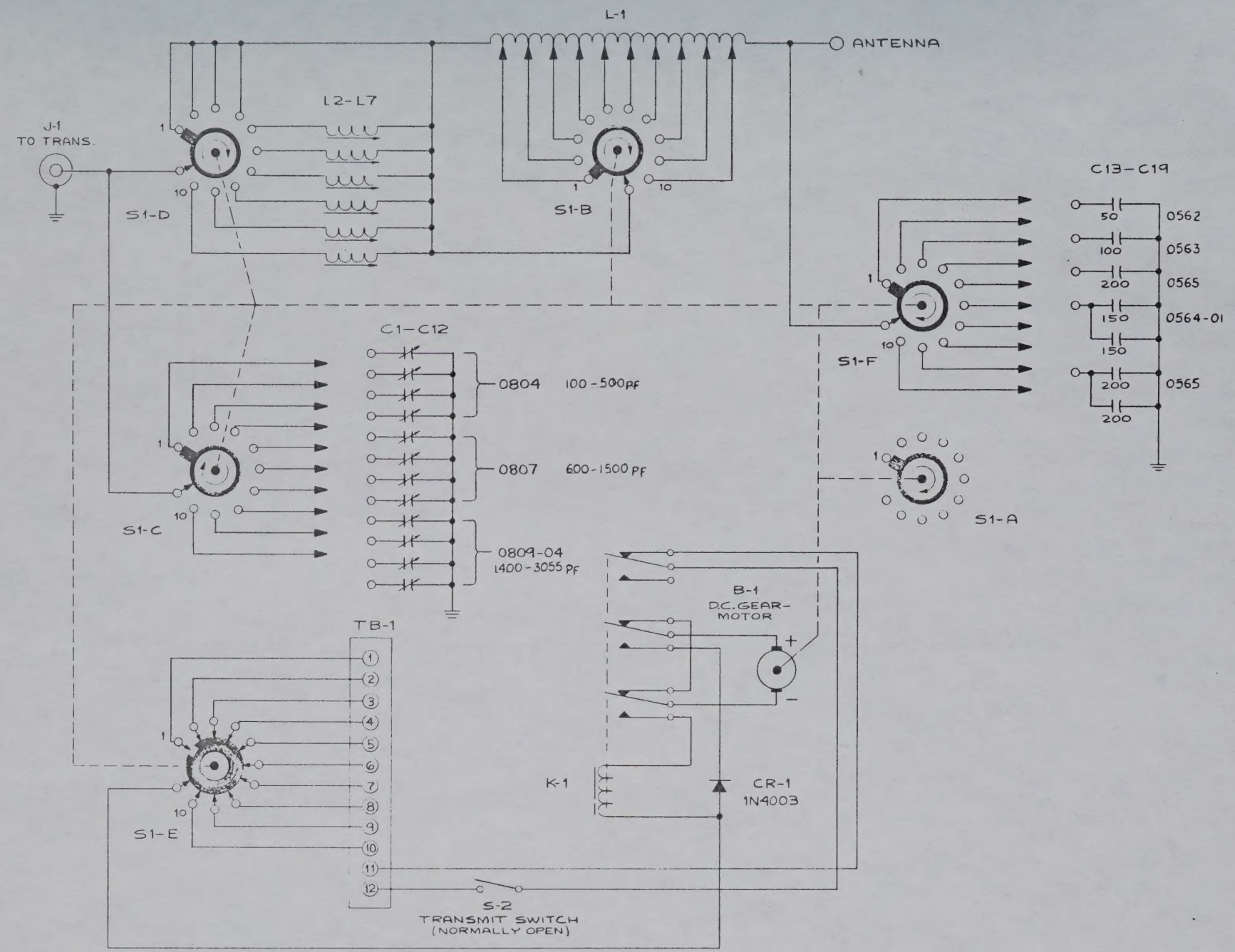
Serial # _____



BANDSWITCH WAFER LOCATION CHART

KR-153SB

NOTE: LETTERS G, I & Q ARE NOT USED



ANTENNA COUPLER, KAC-150A